# CLAIMS

1. A tunable optical source comprising a semiconductor laser diode and a feedback section for providing wavelength selective feedback to the laser diode wherein the feedback section comprises a tunable zone plate device.

2. A tunable optical source according to claim 1 wherein the tunable zone plate device is provided with electrodes for applying an electric field across material of the zone plate device so as to change its optical performance.

3. A tunable optical source according to claim 2 wherein material of the zone plate device has electro-optic characteristics and the change in optical performance is provided by a change in refractive index.

4. A tunable optical source according to claim 3 wherein the material of the zone plate device having electro-optic characteristics comprises strontium barium niobate.

5. A tunable optical source according to claim 4 wherein the material of the zone plate device having electro-optic characteristics comprises SBN:75.

6. A tunable optical source according to claim 1 wherein the tunable zone plate device provides at least part of an external cavity in relation to the laser diode.

7. A tunable optical source according to claim 6 wherein the external cavity is entirely provided in material other than air.

8. A tunable optical source according to claim 2 wherein the tunable zone plate device comprises a piece of material, optically transparent over a range of wavelengths, which, in use, is optically coupled to a facet of the laser diode and transmits optical radiation from the diode to elements of a zone plate.

9. A tunable optical source according to claim 8 wherein the elements of the zone plate are constructed to provide an amplitude zone plate.

10. A tunable optical source according to claim 8 wherein the elements of the zone plate are constructed to provide a phase zone plate.

11. A tunable optical source according to claim 10 wherein the elements of the zone plate are constructed as variations in refractive index in material of the zone plate device.

12. A tunable optical source according to claim 8 wherein the elements of the zone plate device are arranged to image incident radiation, the radiation having a selected wavelength, onto a predetermined image plane.

13. A tunable optical source according to claim 12 wherein the incident radiation is received from an object plane and the object and image planes are coincident.

14. A tunable optical source according to claim 12 wherein the zone plate device is arranged in fixed relation to the image plane.

15. A tunable optical source according to claim 12 wherein the image plane is coincident with a surface of the zone plate device.

16. A tunable optical source according to claim 8 wherein the elements of the zone plate are rotationally symmetric.

17. A tunable optical source according to claim 1, further comprising a mode hop control device.

18. A tunable optical source according to claim 17 wherein the mode hop control device comprises a waveguide together with control means for controlling its optical performance.

19. A tunable optical source according to claim 18 wherein the control means comprises electrodes for applying an electric field to material of the waveguide.

20. A tunable optical source according to claim 19 wherein the waveguide is constructed at least in part in electro-optic material and wherein the electrodes are arranged to apply an electric field to the electro-optic material.

21. A tunable optical source according to claim 18 wherein the waveguide is adapted to increase a received spot size of optical radiation for delivery to the zone plate device.

22. A tunable optical source according to claim 21 wherein the waveguide is adiabatically tapered.

23. A tunable optical source according to claim 8 wherein the tunable zone plate device is optically coupled directly to a facet of the laser diode.

24. A tunable optical source according to claim 17 wherein the tunable zone plate device is optically coupled to a facet of the laser diode via the mode hop control device.

25. A tunable optical source according to claim 17 wherein the tunable zone plate device and the mode hop control device are constructed at least in part from a common piece of material.

26. A tunable optical filter comprising:

i) a zone plate device for frequency filtering of optical radiation so as to deliver radiation of a selected frequency at a predetermined location; and

ii) control means for controlling optical performance of the zone plate device to provide said frequency filtering,

wherein said control means comprises means to change the refractive index of material of the zone plate device so as to change the selected frequency at said predetermined location.

27. A tunable optical filter according to claim 26 wherein the control means comprises means to apply an electric field to said material of the zone plate device.

28. A tunable optical filter according to claim 27 wherein the material of the zone plate device is electro-optic.

29. A tunable optical filter according to claim 28 wherein the material of the zone plate device comprises strontium barium niobate.

30. A tunable optical filter according to claim 29 wherein the material of the zone plate device comprises SBN:75.

31. A tunable optical filter according to claim 26 wherein the zone plate device comprises a piece of said material, the piece of material having zone plate elements on a first facet thereof and said predetermined location coinciding with a second facet thereof.

32. A tunable optical filter according to claim 31 wherein the dimension of the zone plate device from the first facet to the second facet is at least 200 microns.

33. A tunable optical filter according to claim 31, wherein the control means comprises electrodes extending from the first facet to the second facet for creating an electric field in the piece of material.

34. A tunable optical filter according to claim 26 wherein the zone plate device provides amplitude zone plate elements.

35. A tunable optical filter according to claim 26 wherein the zone plate device provides phase zone plate elements.

36. A method of tuning an optical source, which optical source comprises a laser diode optically coupled to a zone plate device for providing wavelength selective optical feedback to the laser diode, wherein the method comprises the step of applying

an electric field to material of the zone plate device so as to change its optical performance.

37. A method of tuning an optical source according to claim 36 wherein the step of applying an electric field to material of the zone plate device changes its optical performance so as to change the wavelength at which the zone plate device forms an image in a predetermined image plane.

38. A method of tuning an optical filter, which optical filter comprises a zone plate device for frequency filtering of optical radiation so as to deliver radiation of a selected frequency at a predetermined location, wherein the method comprises the step of applying an electric field to material of the zone plate device so as to change its optical performance whereby the frequency selected for delivery at the predetermined location is changed.